

# CONSTRUCCIÓN DE UN CLUSTER DE COMPUTADORAS

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ROJ

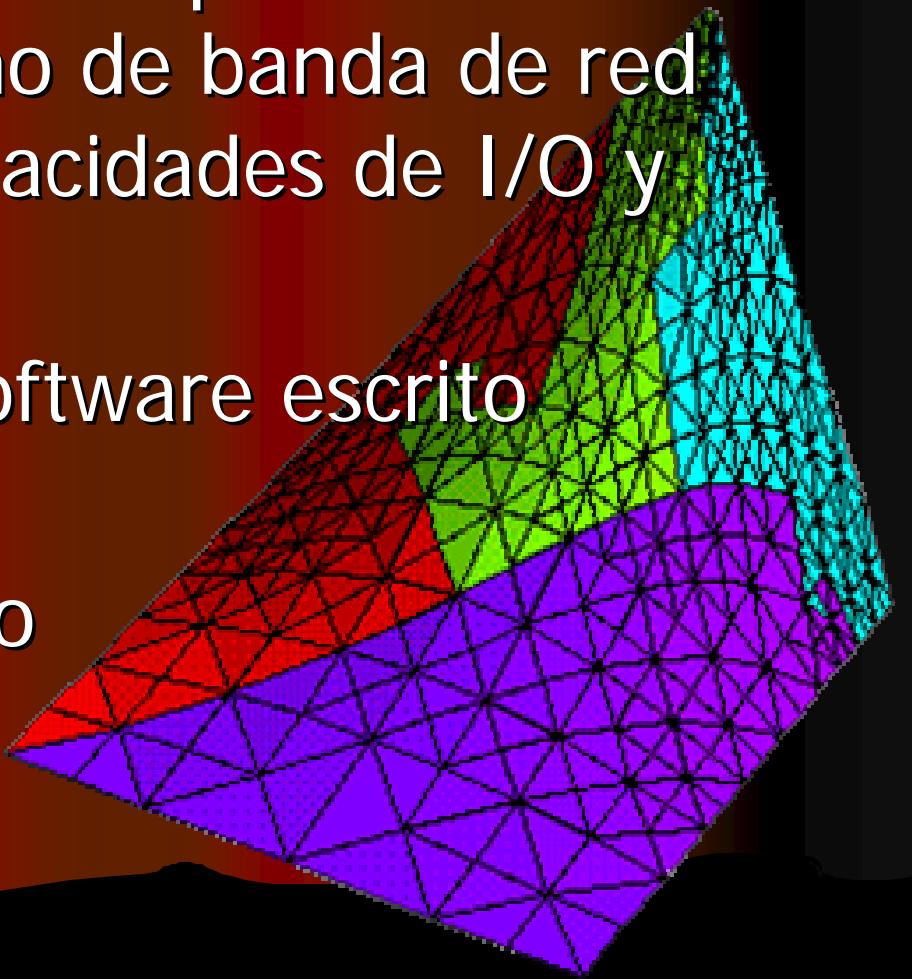


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- Arquitecturas y porqué Cluster
- Componentes del Hardware y Software
- Soluciones con Redes
- Administración del Cluster
- El Nodo en instalación y nuevos Nodos
- Programación y Librerías
- Ambiente Paralelo

# Introducción

- Supercomputadoras= Tiempo de procesamiento + ancho de banda de red interna + grandes capacidades de I/O y almacenamiento
- Sistema operativo y software escrito especialmente
- Procesamiento Paralelo
- No ampliable

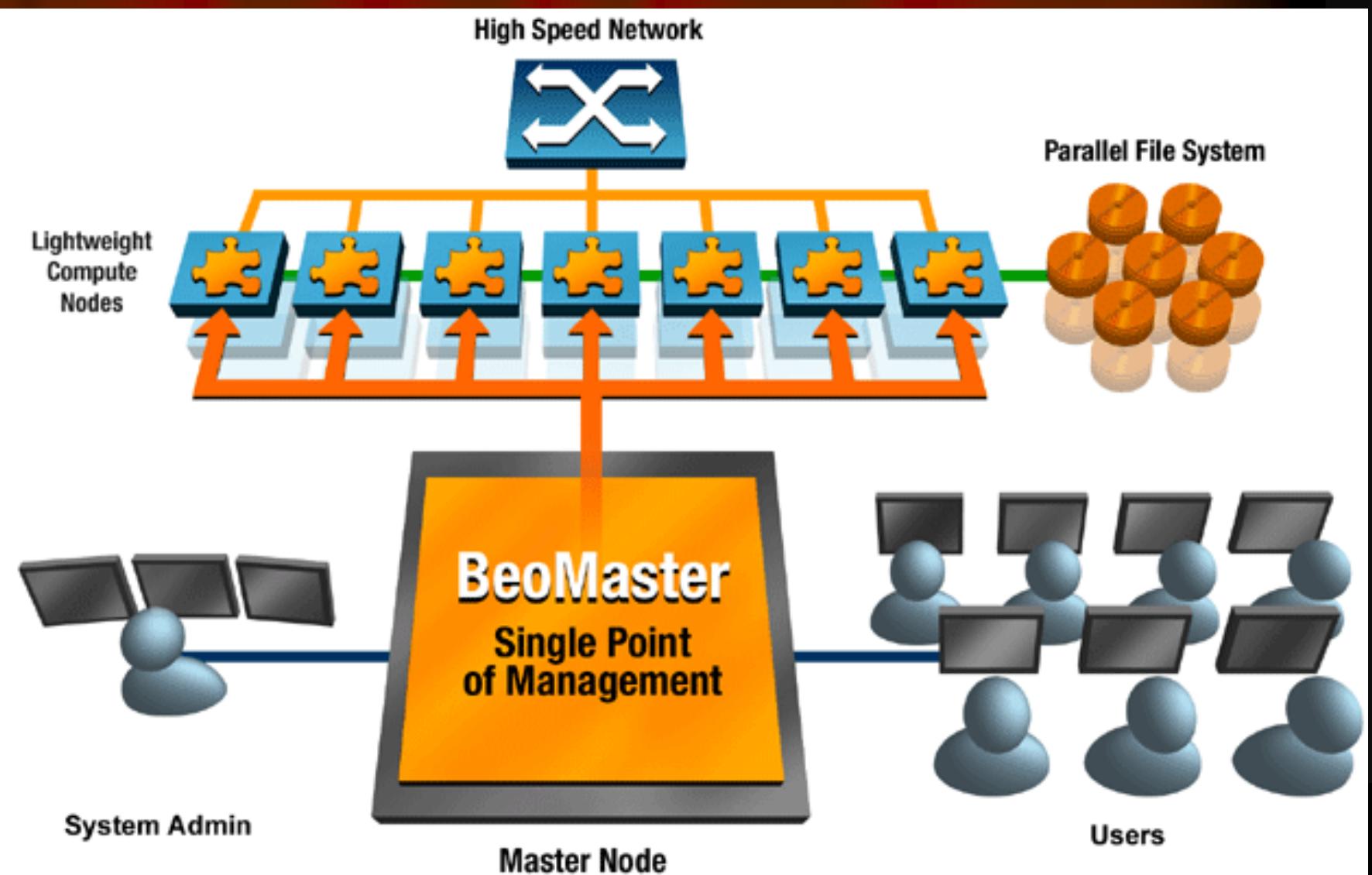


# Arquitecturas y porqué Cluster

- Procesamiento Paralelo
- El uso de “Array Processors” VAX Cluster
- Computo distribuido en base a MPI  
(message passing interfaces)
- File Servers
- Cluster de PC en
- base a Linux
- Fácil Integración



# Estructura



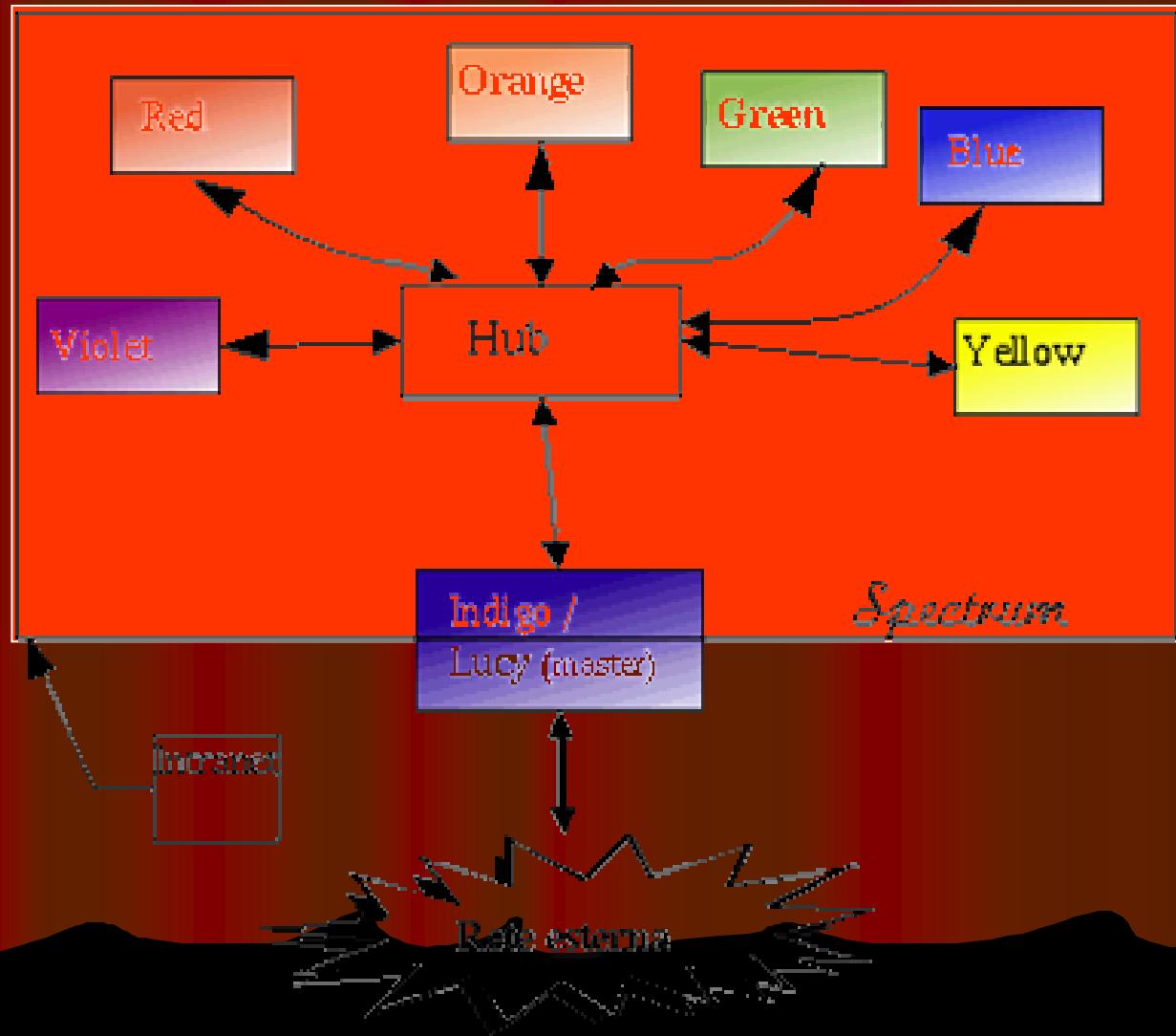
# Hardware y Cluster

- CPUs, tecnologías RISC
- Paralelismo
  - Fino
  - Grueso
- Memorias
  - Cache - nanosegundos
  - Principal – 100 nsec
  - DDR
- Velocidad del Buss
- I/O
- Disco Duro
  - RAID( Redundant Array of Inexpensive Disks)
  - SCSI

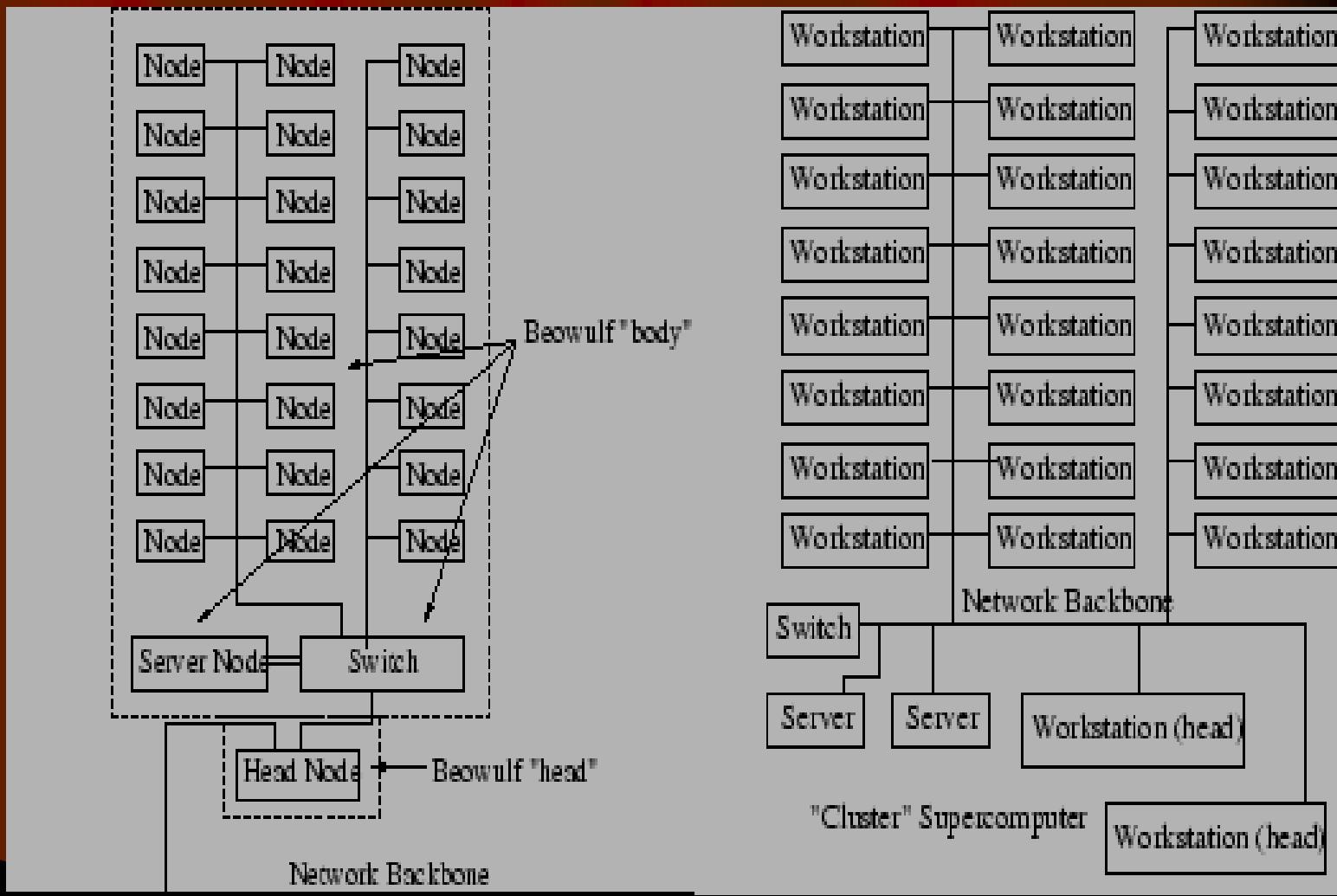
# Software y Cluster

- Granularidad
- Dependencia
  - De los datos
  - Del control
- Multiprocesamiento
- Sincronización
- Subordinación de procesos hijos

# Intranet



# Cluster



# Configuración Simple

CLUSTER HOMOGENEO

(4) MICROCOMPUTADORAS

(1) KVM Switch= Keyboard, Video, Mouse

(1) LINUX RED HAT



# CONFIGURACION INICIAL

MONITORES OPCIONALES

SOLO SE REQUIERE UNO , SI

SE DISPONE DEL MÓDULO

KVM X 4



# CONFIGURACIÓN X 8

CLUSTER AMPLIADO A 8  
MICROCOMPUTADORAS  
PUEDE UTILIZARSE PLACAS  
MADRE CON DOS PROCESADORES  
XEON.



# CLUSTER DE 16 PC



# CLUSTER DE 64 PC

COMBINACION DE DIFERENTES  
MODELOS, VERSIONES, CAPACIDADES  
EN PROCESADORES, RAM, DISCO DURO

CASE Norma 3U ( 5.25 inch)  
Norma 2U ( 3.5 inch)



# CLUSTER 29 PC



# CLUSTER MULTI-EQUIPO

CLUSTER HETEROGENEO

INTEGRACIÓN DE  
VARIADOS EQUIPOS  
MARCAS, MODELOS  
VELOCIDADES, RAM  
PROCESADORES, DISCOS  
ETC.

UPS



# SUPER CLUSTER 64 PC

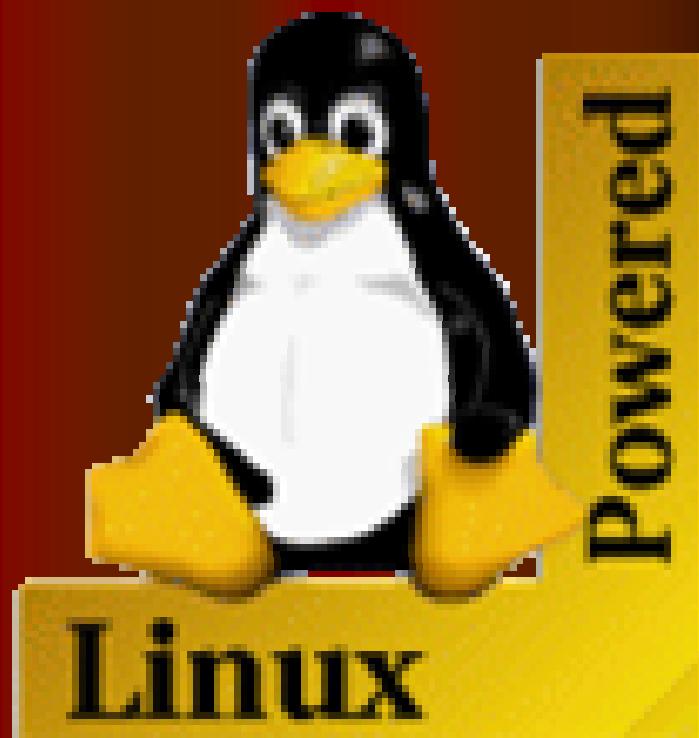


# SISTEMAS OPERATIVOS

## Kernel Linux

SIMPLE O MULTIPROCESADORES  
POR NODO

- REDHAT Linux
- Caldera OpenLinux
- SuSE Linux
- GNU/Debian Linux
- Slackware Linux
- TurboLinux
- SGI Linux



# Componentes del Hardware y Software

- Solución que se busca encontrar
- Paralelismo y multi-procesamiento
  1. SMP- (Symmetric Multiprocessor)
  2. NUMA-(Non-Uniform Memory Access)
  3. UMA-(Uniform Memory Access)
  4. SIMD-(Single Instruction Multiple Data)
  5. MIMD-(Multiple Instruction Multiple Data, Linux Cluster por definición)

# Soluciones con Redes

- Protocolos de redes Ethernet
- Interfaces del hardware (cable o fibra)
- Ancho de Banda en Mbits/seg.
- Hub , Routers o Switches
- Cubos , Hipercubos
- o Redes
- TCP/IP

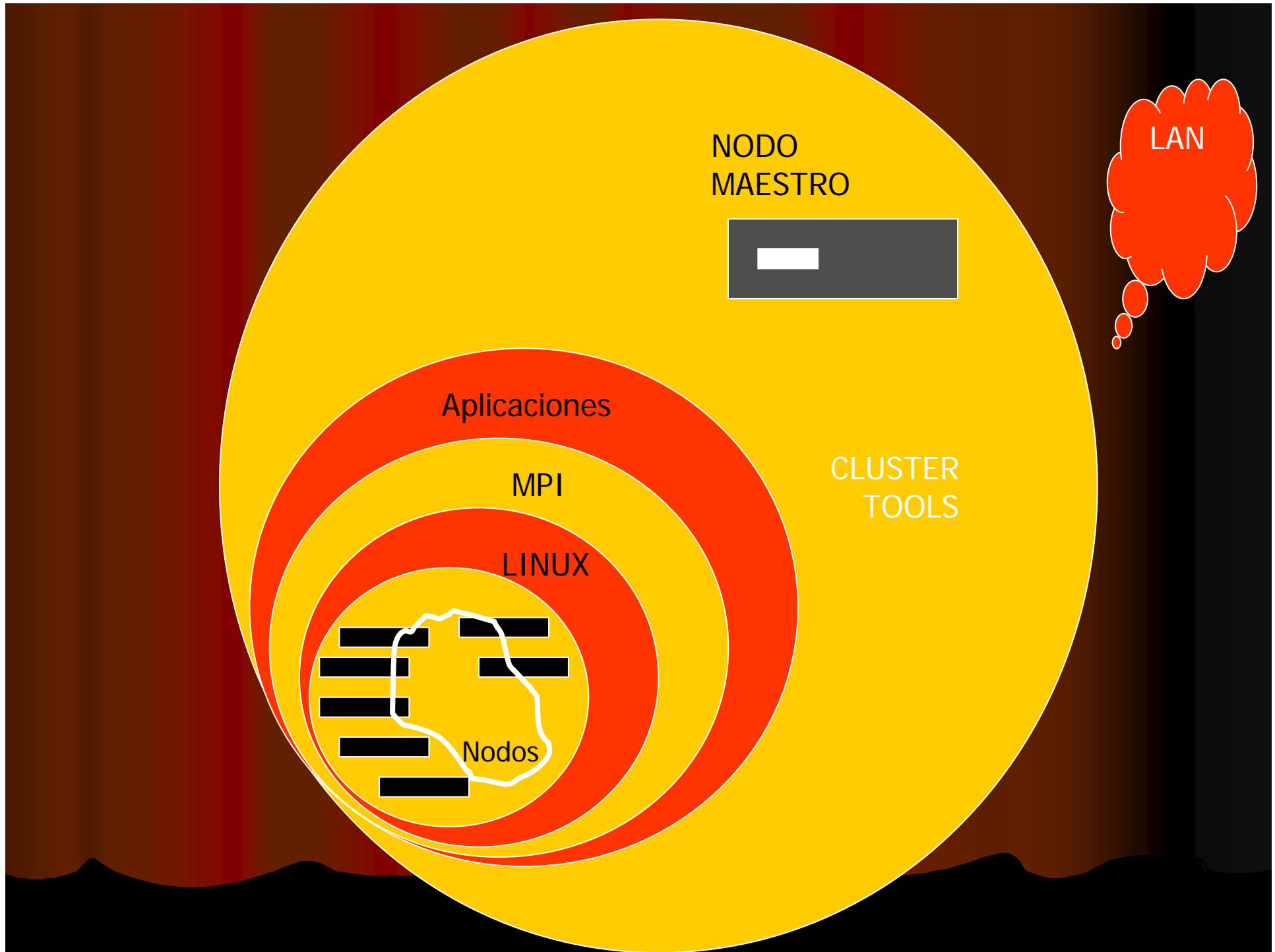


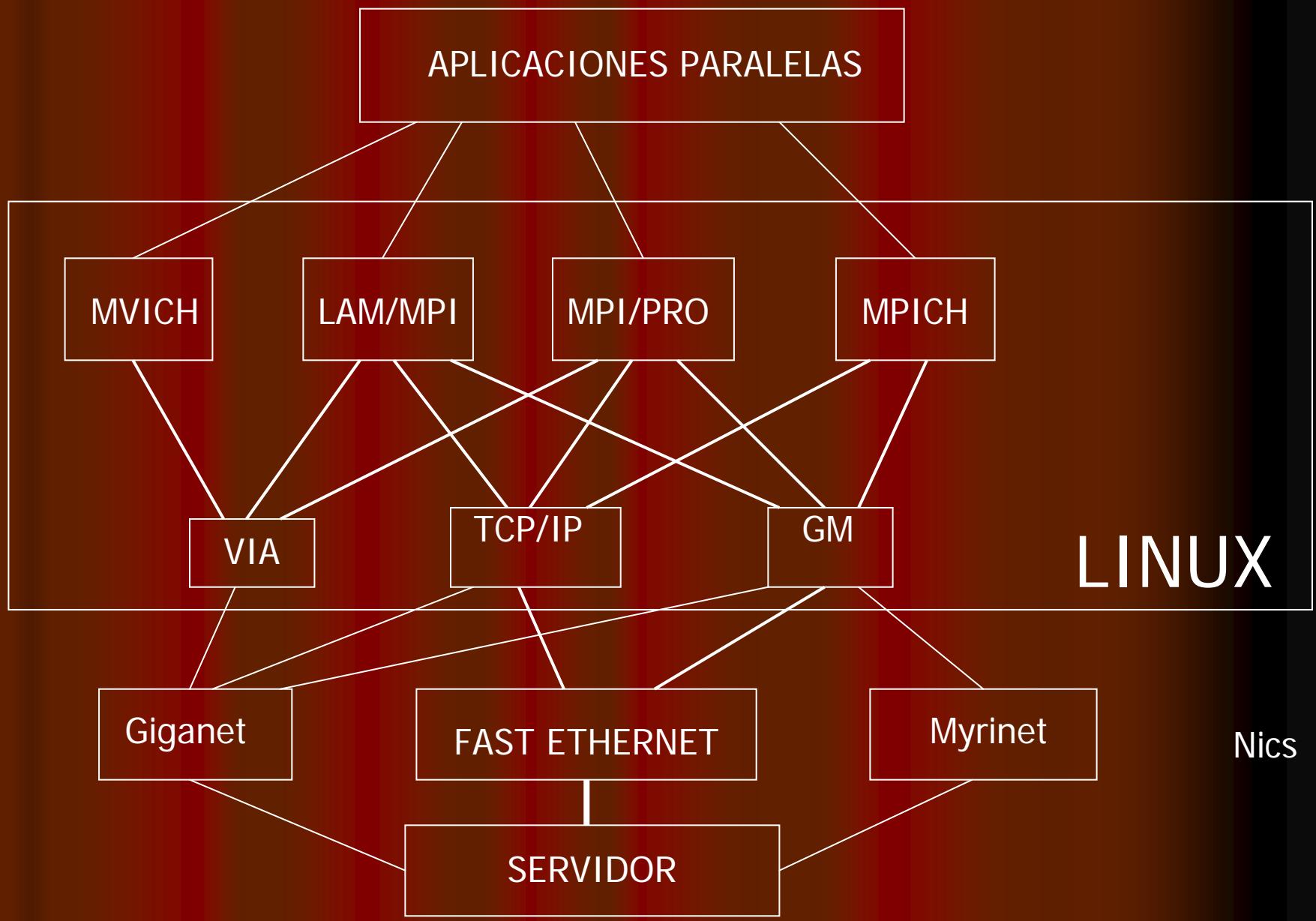
# Comunicación Ethernet

- TCP/IP
  - Clase A 10.0.0.0
  - Clase B 172.16.0.0 - 172.31.0.0
  - Clase C 192.168.0.0 – 192.168.0.0
- Cadenas IP
- Seguridad

# Sistemas de Programación

- MPI - Message Passing Interface
- PVM - Parallel Virtual Machine





LINUX

Nics

# Configuración del Cluster

- Cubos o Hipercubos
- Mallas o Anillos
- Escalabilidad
- Acceso al Cluster
- Sistema de Mensajería

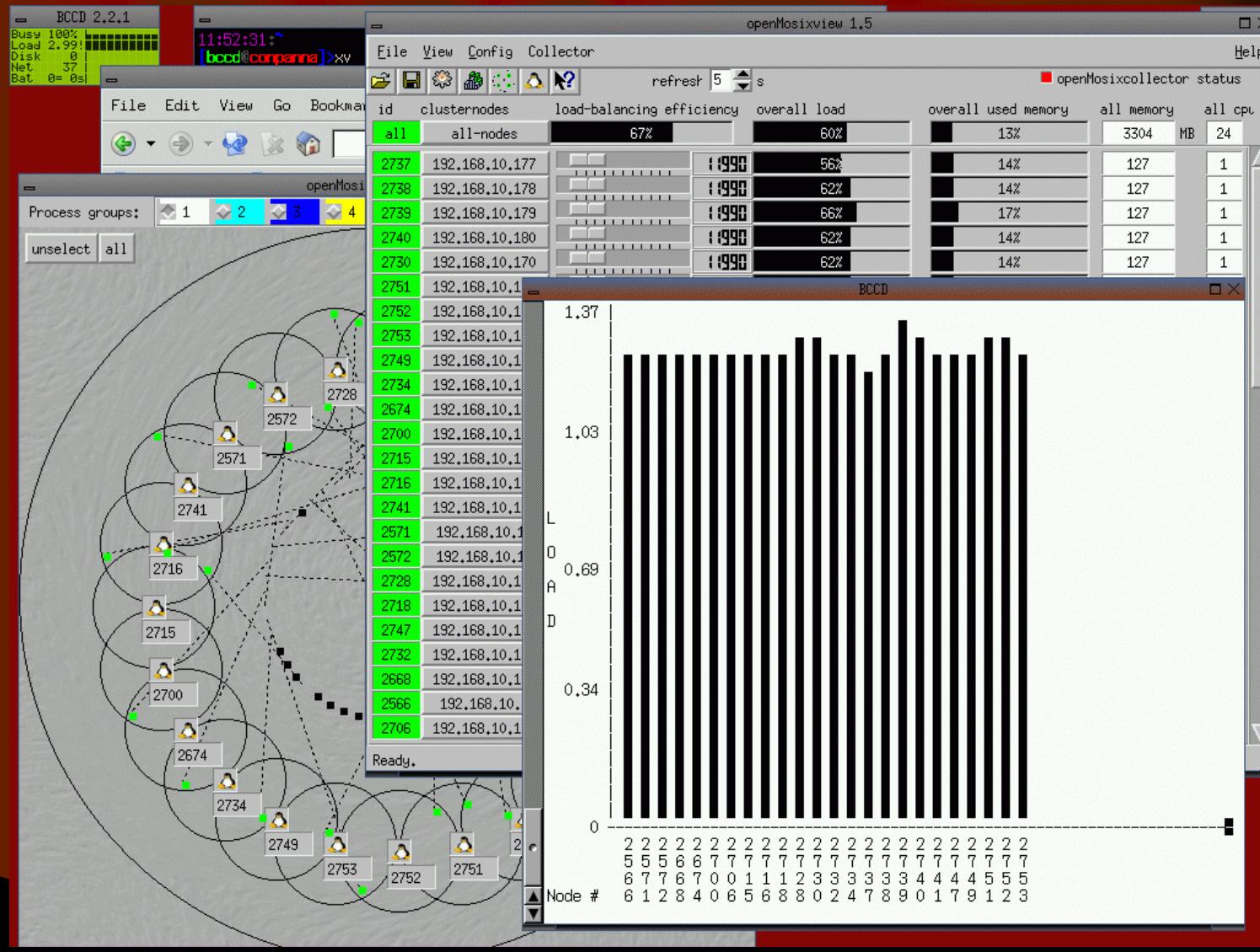


# El Nodo en instalación y nuevos Nodos

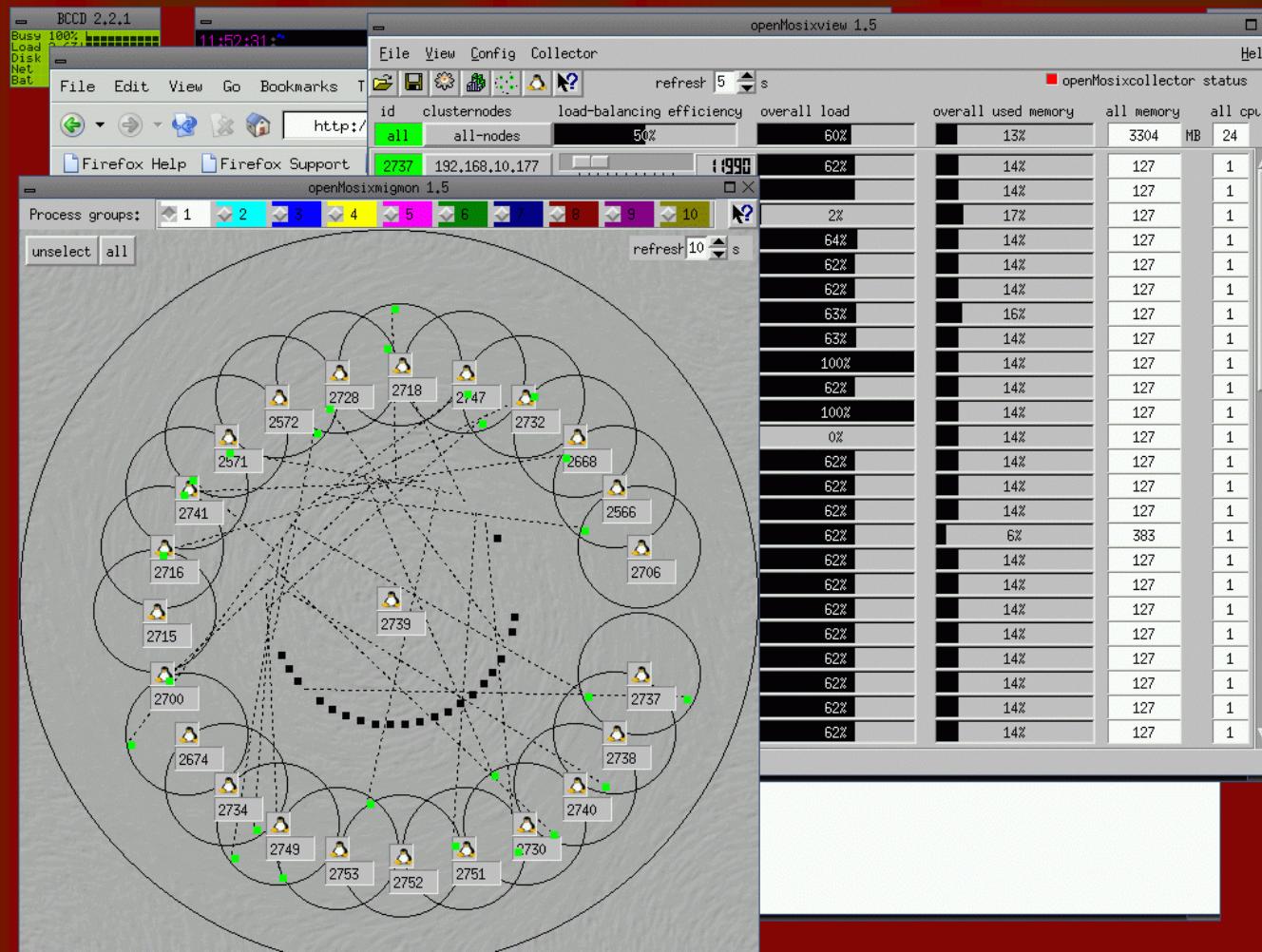
- El Nodo Maestro y el montaje del software
- El Boot del server
- Construcción de los nodos esclavos
- Administración de las cuentas y del sistema



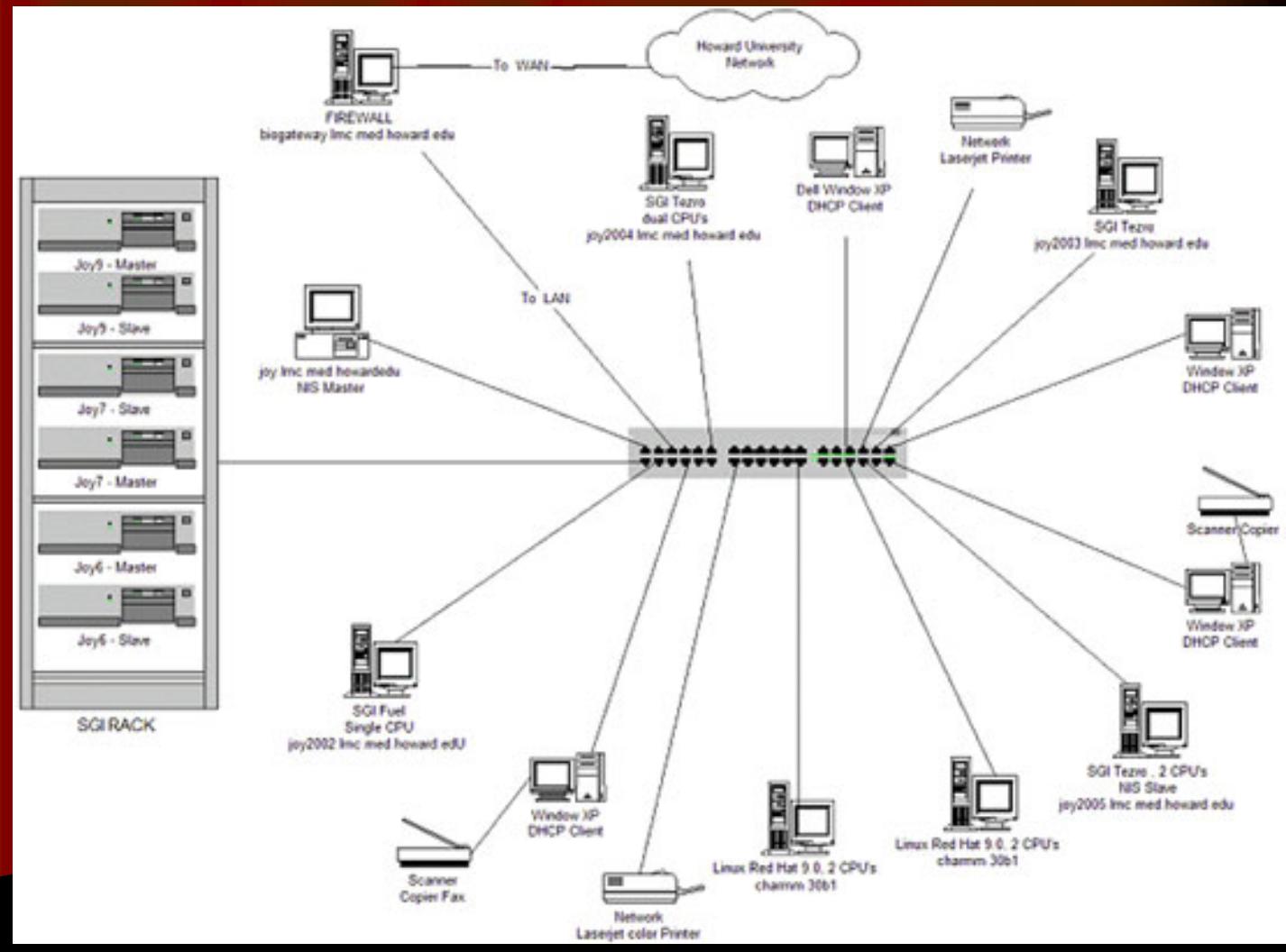
# Administración de la Demanda



# Actividad del Sistema



# Cluster en Red



# Programación y Librerías

- Compiladores
- GNU C , GNU F77/F90
- C/C++
- NAG
- Otras herramientas
- Librerias Paralelo
- Librerias Matematicas



# Desarrollo Paralelo

- PADE - Parallel Applications Development Environment (NITS)
- XPVM - Front-End PVM
- LAM - Local Area Multicomputer
- MOSIX

# Librerías Paralelo

- ACL - Advanced Computing Lab Tools
- SILON – Scripting Interface Languages for Object- Oriented Numerics
- PAWS – Parallel Application WorkSpace
- POOMA – Parallel Object – Oriented Methods and Applications
- PETSc – Parallel scientific computing
- PLAPACK – Parallel Linear Algebra Package

# Software Beowulf

ScaLAPACK

FORTRAN

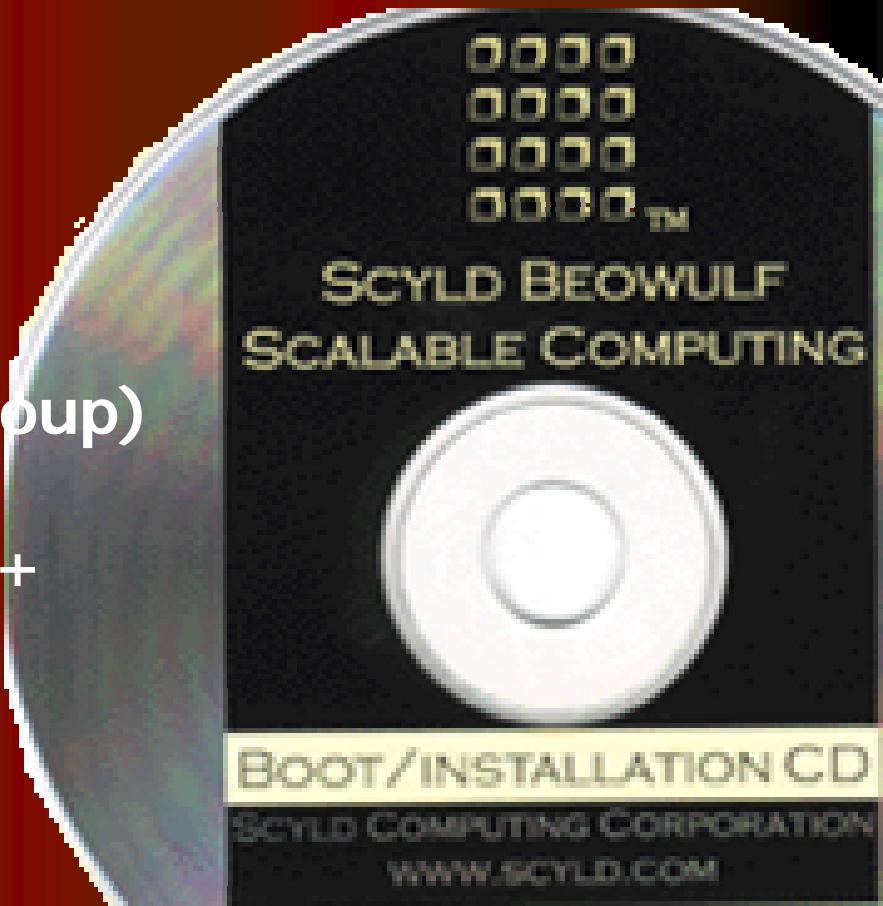
Abssoft FORTRAN

NAG (Numerical Algorith Group)

The Portland Group F90, C++

Parallel Tools Consortium

MAPLAB  
IDL



# Ambiente Paralelo

- El cuarto
- Aire acondicionado
- Potencia Consumida
- UPS
- Seguridad
- Montaje



# SUPER CLUSTER 512 PC

Ambiente Temperado  
Falso piso  
UPS  
Racks

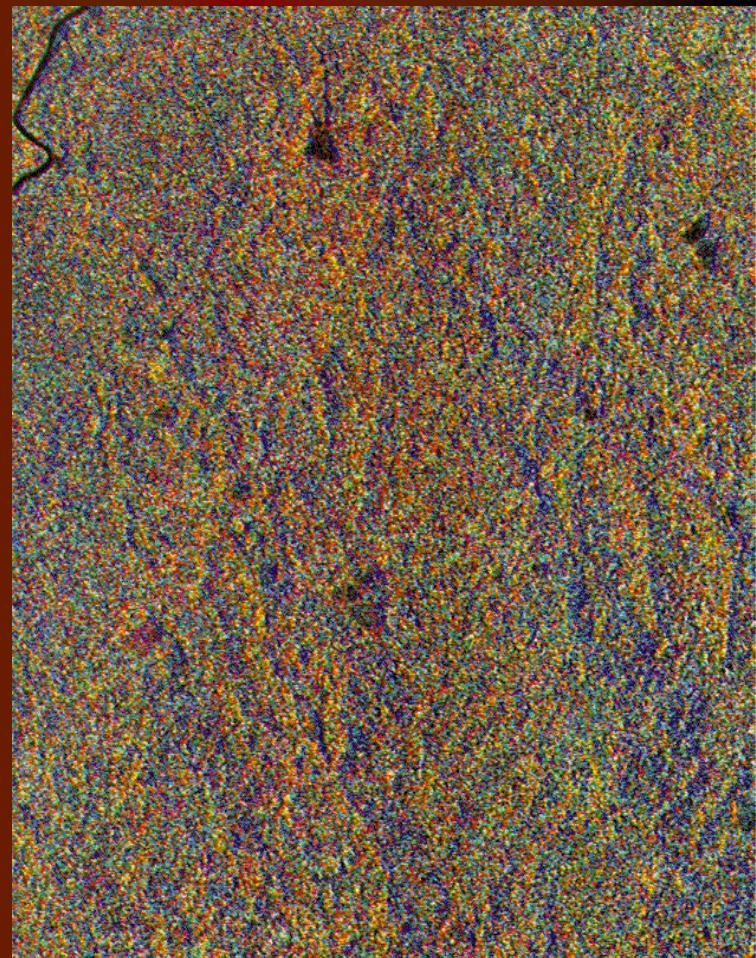


# CLUSTER COMPACTO

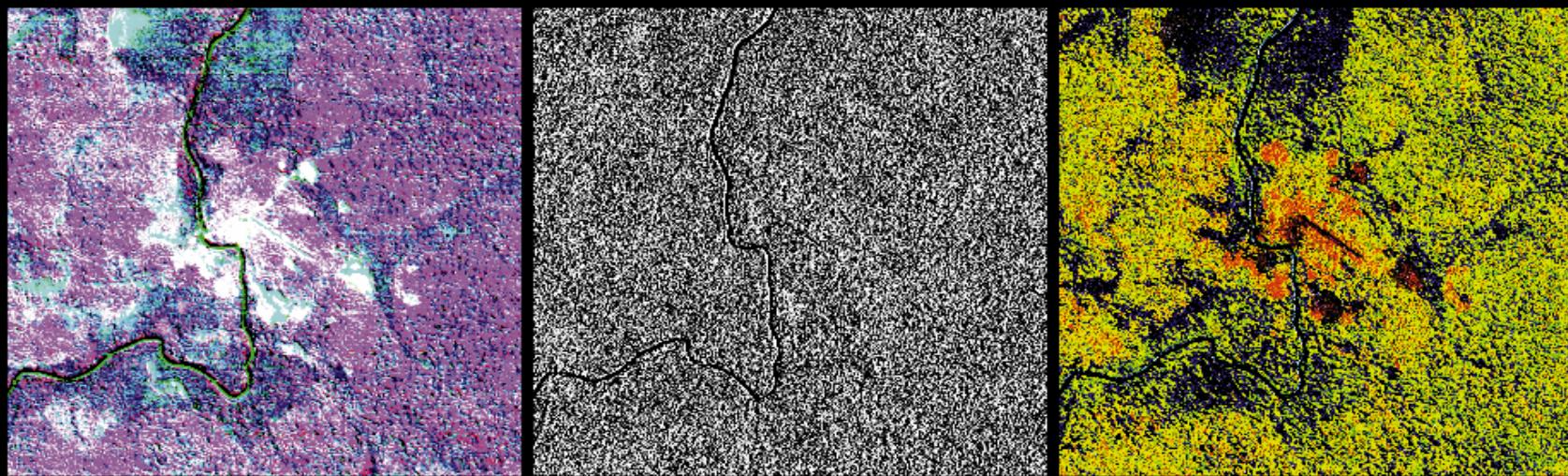
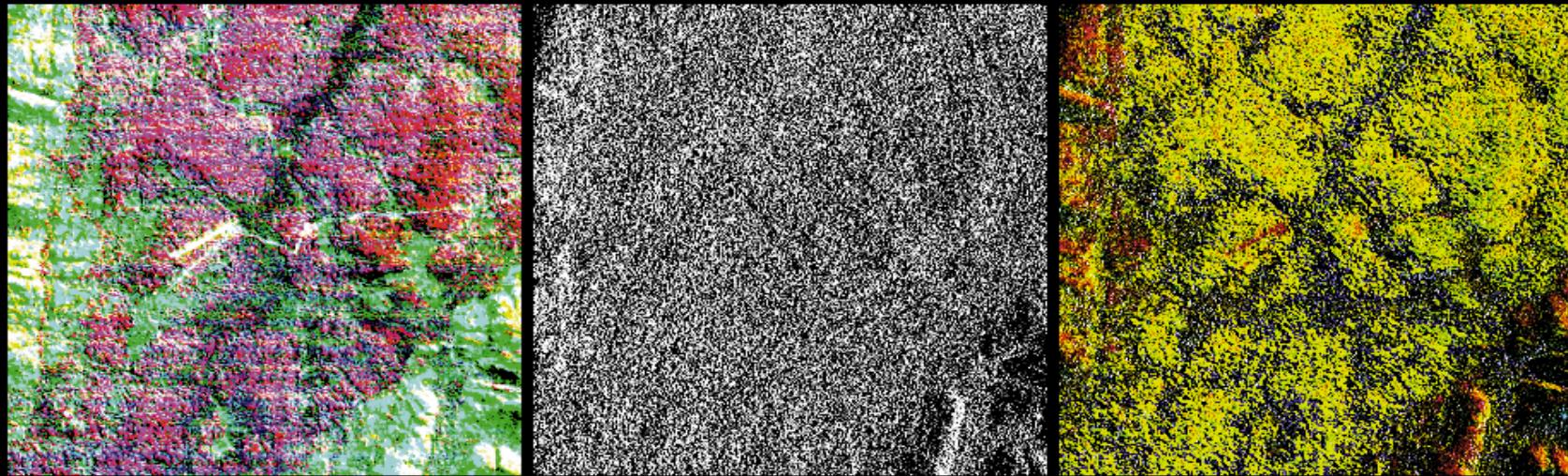


# Procesamiento

Datos SAR del satélite ERS-2  
De la Agencia Espacial Europea  
Procesados por equipo SUN Ultra  
con dos procesadores RISC de 800 MHz.  
Imagen multitemporal de zona de selva  
en el Perú  
250 MB cada imagen

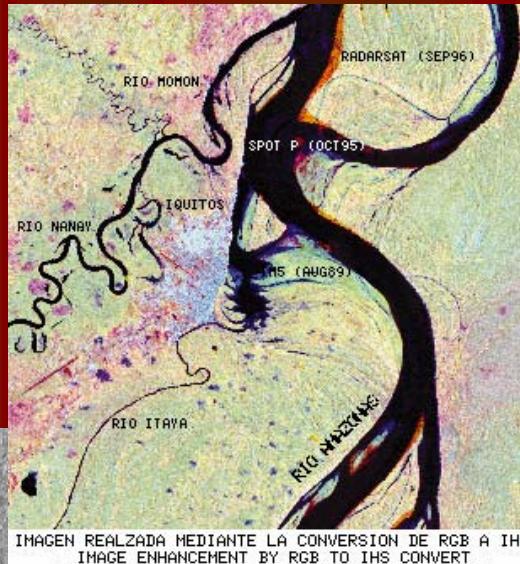


# Composición Multibanda

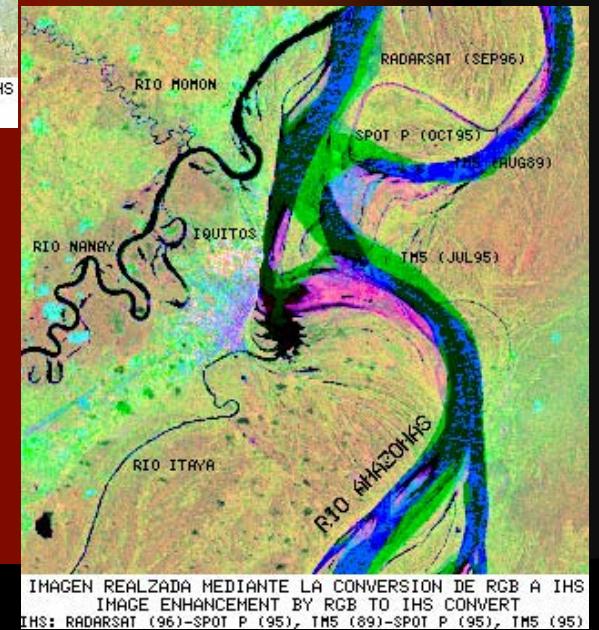


# Combinación de Sensores

Datos SAR  
Radarsat



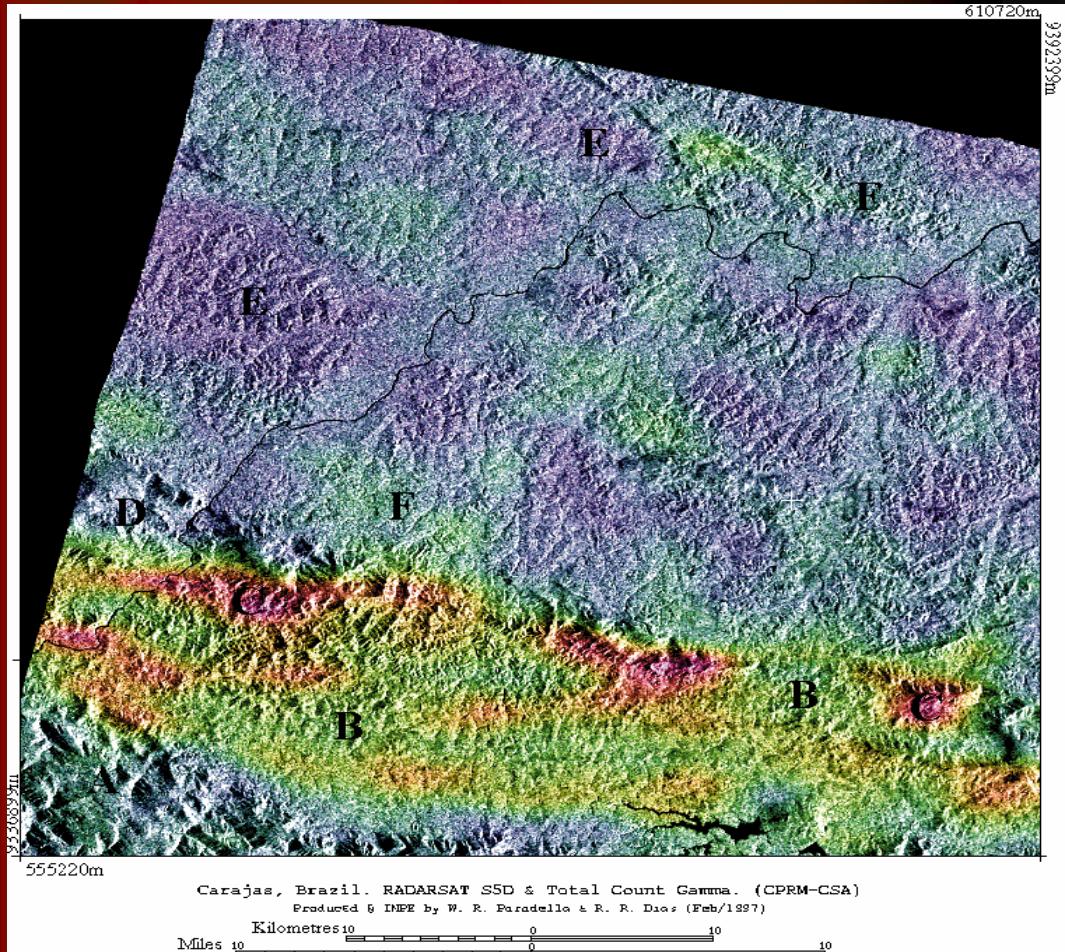
Integración de  
datos  
SAR, SPOT-P, TMS  
Formato RGB



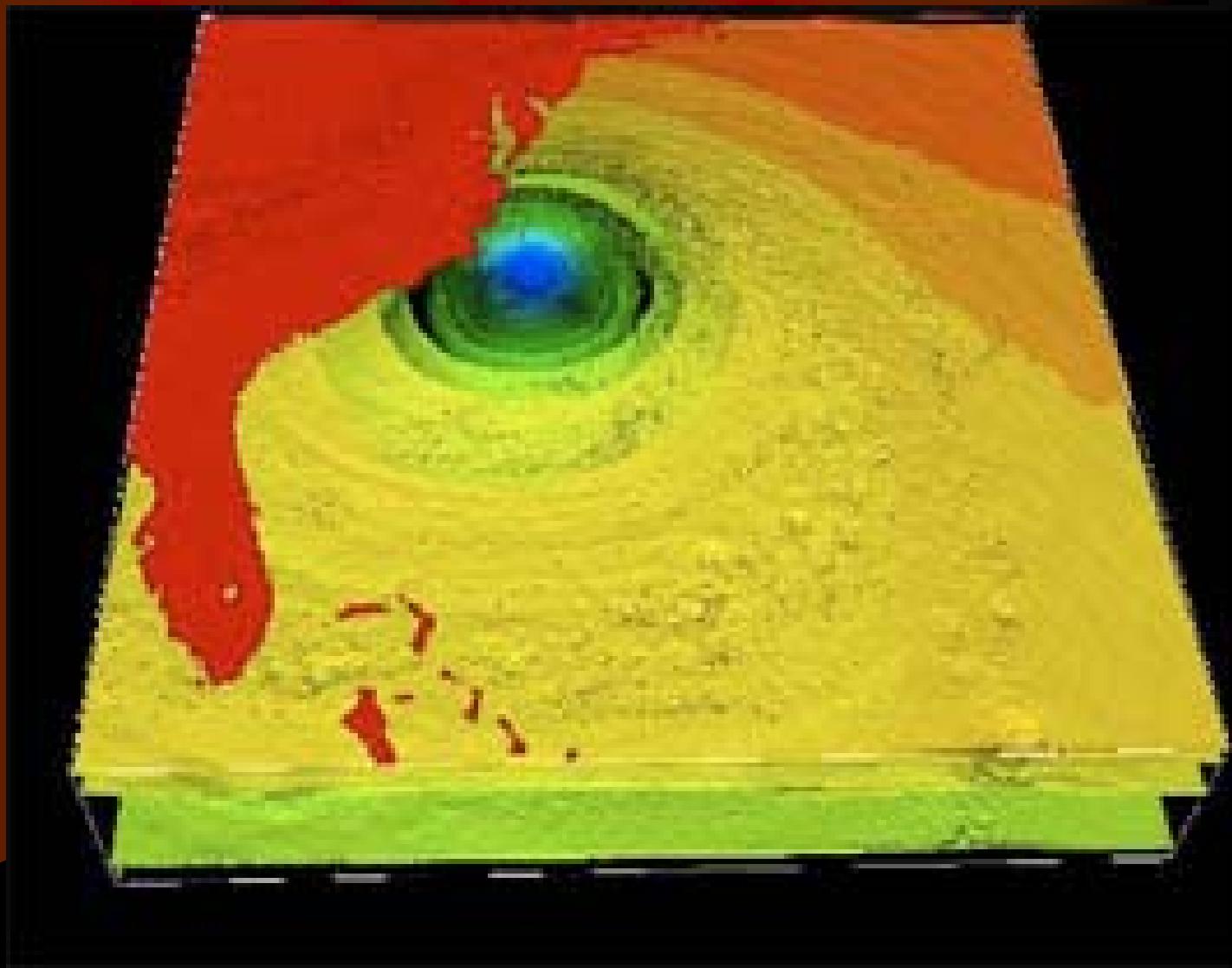
Integración de datos  
SAR, SPOT-P, TMS  
Formato IHS

# Proceso Multitemporal

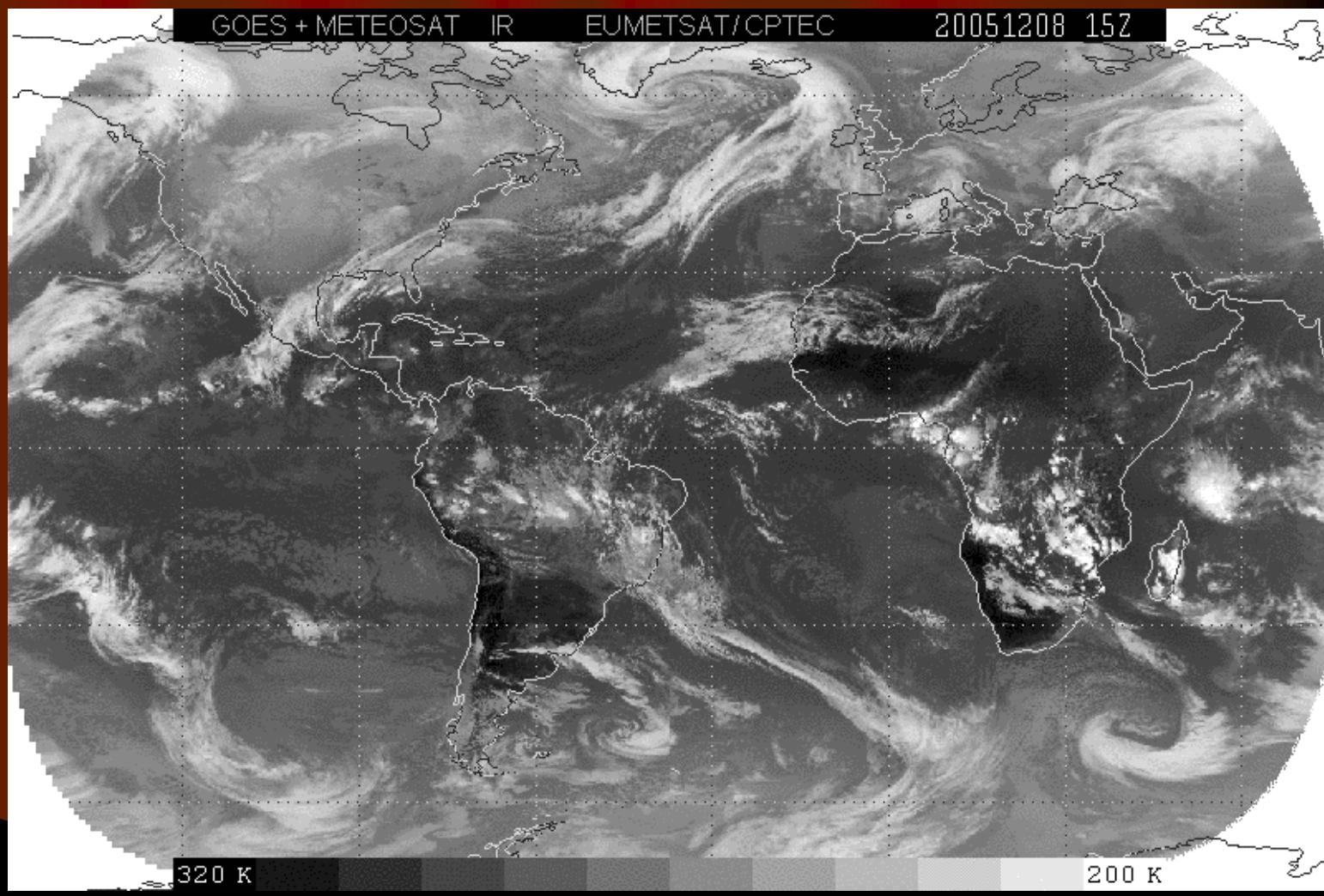
Imagen SAR-ESA  
Procesada en el INPE  
Brasil por computador  
Digital y Array Processor



# Procesamiento • 3D

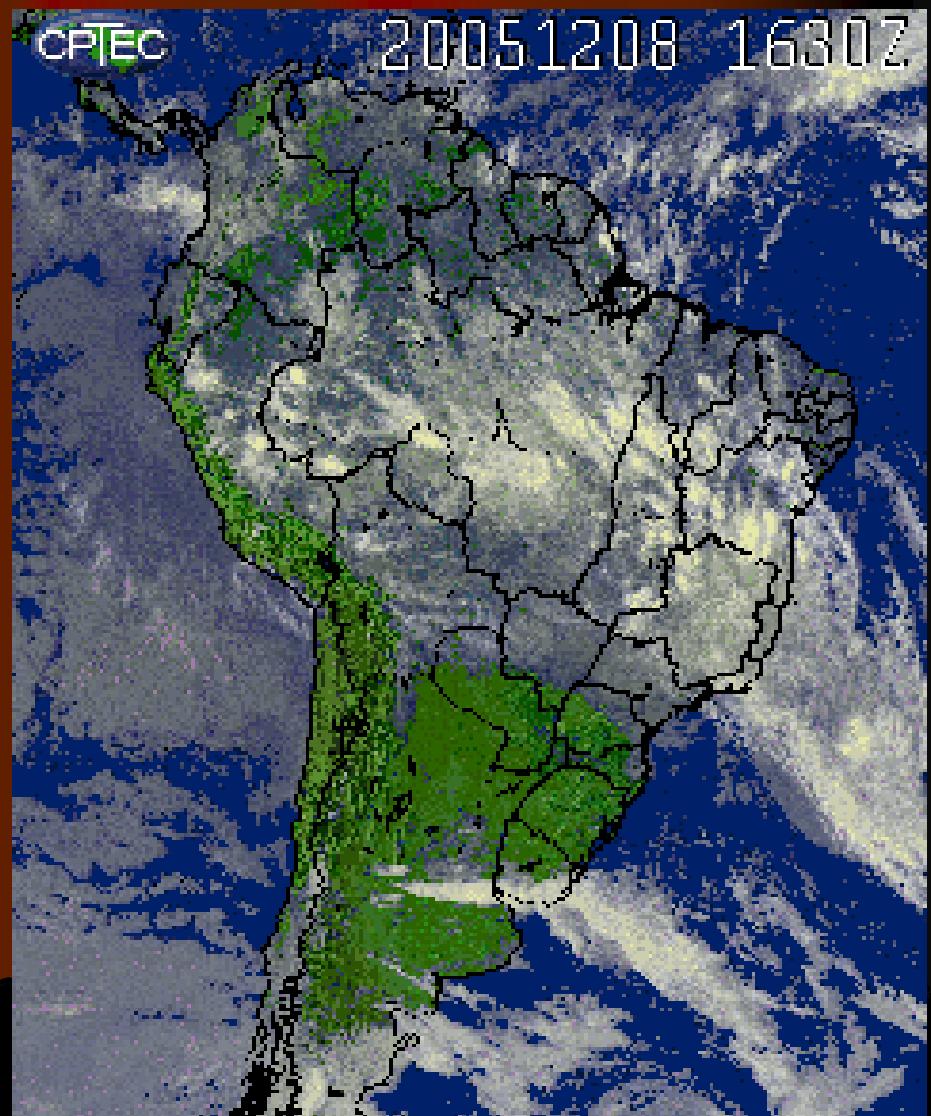


# Imagen GOES



# Goes Regional

Imagen utilizada por el  
CPTEC para pronóstico



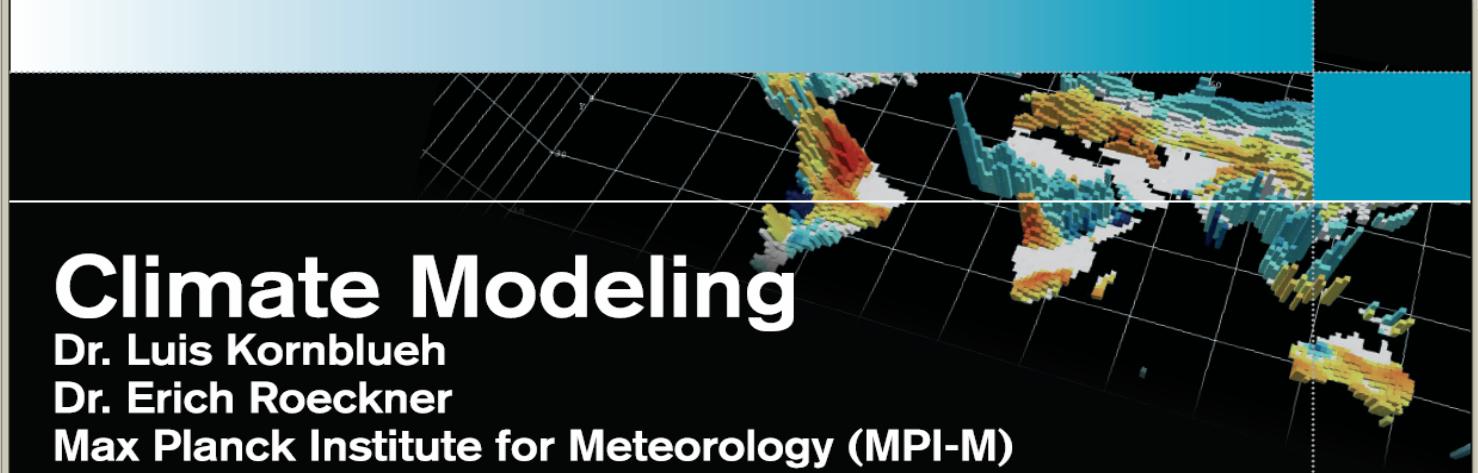
# Modelado ECHAM5

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## Climate Modeling

Dr. Luis Kornblueh  
Dr. Erich Roeckner  
Max Planck Institute for Meteorology (MPI-M)

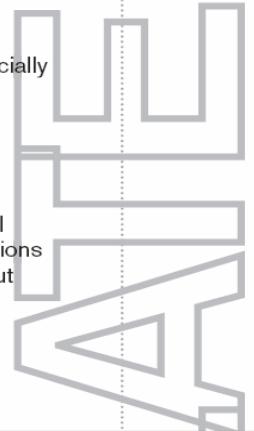
### Science Challenge – Move To Higher-Resolution Global Climate Modeling

- Increase our ability to understand, detect and eventually predict the human influence on climate, especially for the assessment reports of the Intergovernmental Panel on Climate Change (IPCC).
- Model the full earth system, including atmosphere, land, ocean, sea ice and their interactions.

### Why Is This Important?

- Most scientists today agree that global warming is influenced by human activity. Understanding global warming and how humans influence it is important for policy decisions that could affect the lives of billions of people around the world. The IPCC assessment reports document our advancing knowledge about these topics.

### HPC Challenge – Scaling ECHAM5 Performance To New Levels



# Modelado Sismico

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Páginas

3D Seismic Earthquake Models

Pittsburgh Supercomputing Center

Investigators developing 3D seismic earthquake models of geologically complex Greater Los Angeles Basin.

These models include spatial scales from 10 meters to 100 km, and temporal scales from hundredths of a second to hundreds of seconds, based on highly complex soil properties and geological structures that can only be observed indirectly.

**Desired Outcomes**

- To simulate a magnitude 7.7 earthquake centered over a 230 km portion of the San Andreas fault at much higher resolution than has previously been performed.

**Why is this important?**

- This work may help provide more accurate forecasts of ground motion, and help predict the impact a quake is likely to have on a given area.
- By identifying areas in particular danger, results can be used to modify building codes, provide for safer structures, and potentially save lives.

The Largest Unstructured Mesh Simulations Ever Performed

1 de 1

# Modelado Climático

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Páginas

Long Term Global Climate Simulations

Mark Taylor  
Sandia National Laboratories

Science Challenge – use Spectral Element Atmospheric Model (SEAM) for Multi-Resolution Climate Modeling

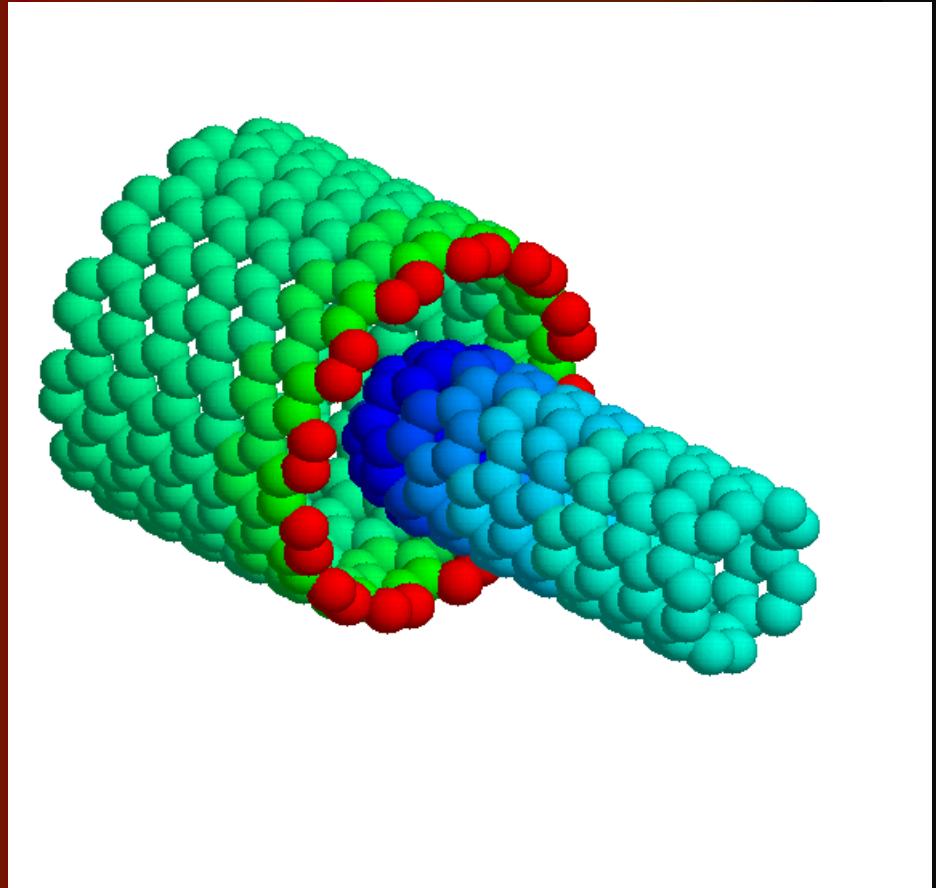
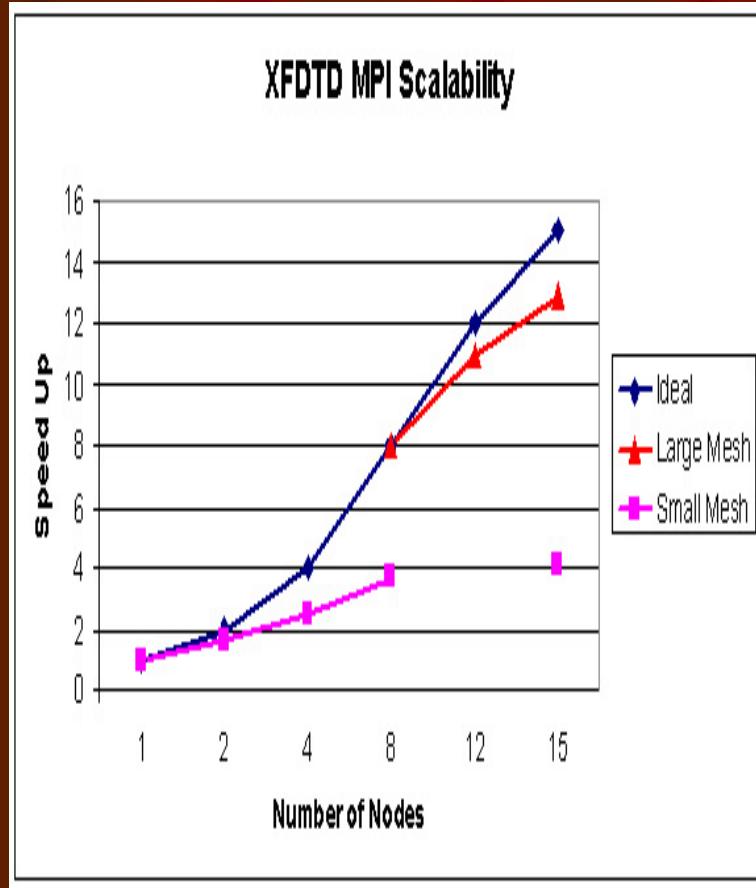
- Develop an improved way to do long term global climate simulations with greater resolution and accuracy.
- Couple SEAM to Community Atmospheric Model (CAM).

Why Is This Important?

Climate change affects socio-economic issues such as water resources, agricultural productivity, food security, ecosystems, human health and human settlements. Long term global climate simulations provide vital information in society's ability to understand the impact of climate change and develop appropriate mitigation policies and technologies.

1 de 1

# Modelos 3D





**BUNYIP**